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The 2.8 and 3.1 liter, Generation II V6

by Kevin Carpenter

The 2.8 and 3.1 liter, Generation II V6 engines produced by Chevrolet were used by Chevrolet, Pontiac, Buick, Oldsmobile, and Cadillac in certain front wheel drive models between 1987 and 1993. These engines may use a unique air/fuel ratio calculation strategy at throttle openings of 2% or less (i.e., idle). Systems that use this type of fuel calculation strategy include those used on 1987 and 1988 engines which have had a "speed-density update" by means of a mem-cal replacement. This is a change which effectively bypasses the system's use of the mass airflow sensor as an input to the ECM. When the airflow sensor output is ignored, the MAP sensor's output is used for the speed-density calculation. However, these systems only operate in speed-density mode at throttle openings of greater than 2%.

At throttle openings of 2% or less, these systems base their calculation of appropriate air/fuel ratio on idle air control valve position. To do this, the system must "learn" how much air can be expected to flow into the engine at a base, closed-throttle reference point with the vehicle idling in drive for automatic transmission cars and in neutral for those equipped with manual

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transmissions. This, in turn, requires that the system determine the number of IAC counts needed to produce a base idle speed. This learning process should be conducted in accordance with the "idle re-learn procedure" as described in Chevrolet bulletin #91-114-6E.

Because these systems base the air/fuel ratio calculation on an "assumed" air flow, which is dependent on IAC valve position rather than on any direct measurement, they become susceptible to severe air/fuel ratio errors when conditions become altered from those which the ECM "expects." For example, these systems will enlean in response to vacuum leaks that provide more air flow into the engine at throttle openings of 2% or less than the ECM has come to expect, based on learned values.

Another type of air/fuel ratio error can occur when IAC valve position becomes inconsistent with the number of IAC counts. This count is kept track of by the ECM as it cycles the valve in and out. If the valve is opened less than it should be for a given number of IAC counts, less air will flow into the engine than the amount which the computer expects, and excessive fuel will be provided. Conversely, if the IAC valve opening is larger than expected for a given number of counts, more air will enter the engine than the amount which the ECM expects, and a lean condition will result. However, once the system has entered the speed-density mode of operation at greater than 2% throttle opening, IAC valve position and vacuum leaks will no longer affect the air/fuel ratio of these systems.

This potential for air/fuel miscalculation at idle

makes proper performance of the "idle re-learn procedure," referred to earlier in this article, critical on these engines. It also makes IAC valve faults more likely to produce stalling and rough idling conditions. One of the IAC-related problems which is common on these engines results from a tendency for the IAC valve to extend beyond its commanded position while the vehicle is being driven at a steady state throttle opening. As the valve extends, which normally occurs when the ECM cycles the valve toward the closed position, thereby reducing the number of IAC counts, airflow becomes restricted. When valve extension occurs, which is unaccounted for by the ECM, fueling at idle also occurs. Symptoms of this can include chugging, black exhaust smoke, and lower-than-normal integrator numbers (often less than 100) as observed on a scan tool.

These systems have a great tendency to produce this "undesired" valve extension. This is particularly the case with engines that are equipped with earlier designed valves. These IAC valves have a tensioning spring which pushes the valve in the closed (extended) direction. The spring tension used on the early versions of these valves was determined to be excessive, which overcomes the natural friction of the valve mechanism when its components expand under high temperature conditions. The earlier version used either a green or yellow spring, while the later version uses a black spring. If an updated IAC valve is needed to repair the vehicle, the later version of the valve should be available at any General Motors dealer. A visual inspection will reveal its spring

color, which should be black.

The most common symptom associated with undesired IAC valve extension is stalling at stops following an extended drive cycle. This stalling may repeat itself stop after stop until the vehicle is shut off. Once the key is cycled to the off position, the ECM remains powered up for approximately ten seconds. During this time, it resets the valve, regaining track of its position. In many cases where motorists are experiencing repeated stop-after-stop stalling, they do not cycle the ignition switch to the off position long enough to reset the valve before restarting the engine.

Stalling due to undesired IAC valve extension may also occur on start up after the vehicle is shut down when hot. High soak temperatures can cause unintended valve extension. Because the ECM resets the valve at the time the key is shut off, the ECM will be "unaware" of any valve extension that occurs after reset as a result of high underhood temperatures. When the engine is restarted, the ECM will extend the valve a specific number of counts, in accordance with its program. If the valve is already extended, it will become excessively extended and may close off its air passage entirely, resulting in an engine stall. This stalling condition is also likely to repeat until the key is cycled to the off position and the valve is reset. These problems can be corrected with a new IAC valve, cleaning the throttle bore, and performing a re-learn procedure covered in Bulletin #91-114-6E. For further information in helping diagnose IAC problems, please refer to

Bulletins #88-440-6E, Stall, Tip-In, Hesitation, and #89-177-6E, IAC System.

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